Coating Methods

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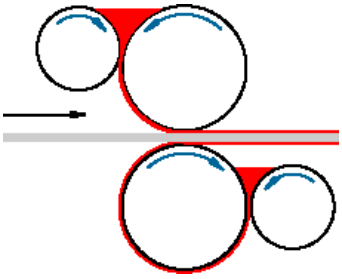
The coating of gaskets has been an integral part of the gasket industry since its beginning. The processes that are used to apply them take a variety of forms, some crude with variable results and some very precise with consistent results. This article will attempt to point out some of these methods used in the gasket industry as well as others from other industries which may have some applicability in your application.

Gasket coatings are used in the form of adhesives, seal coatings, branding and other applications, both thick and thin. Each class of coating may require a different process depending of the formulation, handling properties, finish and desired thickness of the coating. Some of the processes are only applicable to the continuous coating of materials in coil form. Other methods can be rather simple and crude such as roll or spray painting by hand.

Most gasket sheet materials can be purchased with a wide variety of coatings already applied using the manufacturer's online or offline coating processes. These pre-applied surface coatings might be seal, anti-stick or markings identifying the manufacturer or material grade. There are, however, circumstances where these pre-applied coatings may not be desirable. In these cases, the gasket manufacturers may be creating an assembly of parts into the final gasket and applies the coating as the final process. This is where the first two methods are commonly used: 4-roll or 2-roll coaters.

4-ROLL, 2-ROLL: This method consists of a mechanical coater with four rolls, 2 elastomeric faced steel rolls and 2 smaller, steel "doctor rolls". Adjustment of the gap between the doctor rolls and the coating rolls determines the thickness of the coating. The coating rolls propel the material through the process. This method is applicable for coating coils, or sheets and manufactured parts provided they are significantly rigid and flat. The object is to apply the minimum of pressure on the parts or material to be coated to achieve a uniform coating. The amount of pressure needed will vary according to the stiffness and flatness of the part.

This 4-roll method is used to apply a coating to both sides of the product at a time. Depending on the nature of the coating, damage can occur on the underside coating from handling. If appearance and cosmetics are tantamount, the coating of a single, topside, can be made with a similar machine, substituting a solid steel roll for the bottom coating roll and eliminating the bottom "doctor" roll. If both sides are to be coated, the first side would be cured or dried and then the process repeated on the second side.

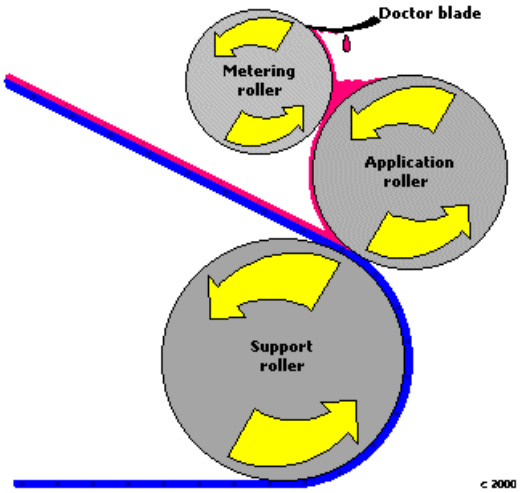


In a 2-roll machine, the lower roll would be replaced with a steel faced roll and the lower doctor roll could be replaced. Some users may simply have both metal and rubber faced rolls which can be swapped.

Both the 4-roll and 2-roll methods will produce a surface effect which is commonly referred to as "chicken tracks" and can be seen in the following photograph:

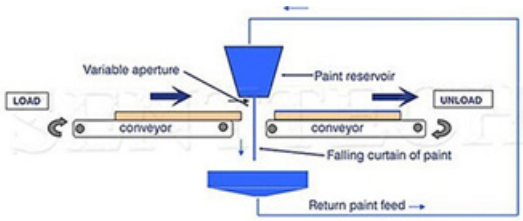
This effect can be minimized by adjusting the coating formulation, film thickness or the contact pressure adjustment.

REVERSE ROLL COATING: This is a process best suited for continuous coating of a coiled substrate. In this procedure, the coating material is measured onto an applicator roller by precision setting of the gap between the upper metering roller and the application roller below it. The coating is wiped off the application roller by the substrate as it passes around the support roller at the bottom. This figure illustrates a 3-roll reverse roll coating process, although 4-roll versions are common. After coating, the product flows immediately into a curing oven at high temperatures. This process is commonly used for high-speed production of continuous product. The finished product is pulled through the process by a coiling machine but must first pass through a curing phase before coiling. The properties of the various coatings are like those applied with the curtain coating process.



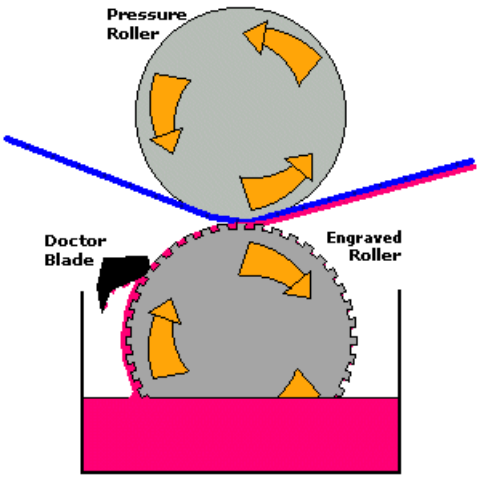
CURTAIN COATING: In the curtain coating process, an overhead bath with a uniform slot in the bottom is positioned between two conveyers. This bath is usually pressurized, and the slot is adjustable. This slot allows a continuous curtain of a coating to fall into the gap between the two conveyers. The object to be coated, whether sheet or semi-finished part, is passed along a conveyer at controlled speed and so receives the coating on its upper surface. The surface speed of the conveyer closely matches the falling rate of the coating film, laying the film on the surface without stretching it. This method can be used on materials with minor 3-dimensional properties. It was used in the past for coating embossed metal gaskets and is and has been used for the application of rubber coatings to fabricated multi-layered laminate gaskets or their individual components. It is a very quick process.

The coatings are generally solvent based with low solids content (20-25%). Combining this process with the low solids coating yields a very smooth and precise, but thin, coating. The coating must be extremely homogenous and clean. Any solid bits can clog the narrow slit and cause "curtain breaks". Unless carefully controlled, scrap rates can be high because of incomplete coverage of the coating. Air bubbles can be a problem as well.

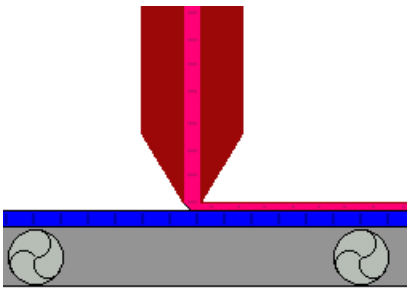


SPRAY COATING: The spraying of coatings is sometimes used for gaskets. The secret is to have a coating that can be easily sprayed and controlled for uniformity of thickness. Shown below is a multi-layered steel head gasket where the final coating has been sprayed using a mask to cover areas not to be sprayed. One of the disadvantages of spraying is that the spray material usage can be high because of over spray.

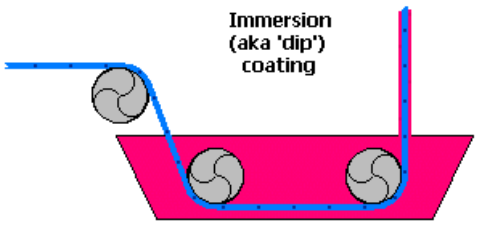
GRAVURE COATING: The gravure coating process relies on an engraved roller running in a coating bath. This bath fills the engraved lines of the roller with a coating material. The doctor blade wipes off the excess coating on the roller and the coating is then deposited onto the substrate as it passes between the engraved roller and a pressure roll. This process is most often used for the branding of gasket materials.



SLOT DIE OR EXTRUSION COATING: In the slot die process, the coating is squeezed out by gravity or under pressure through a slot and onto the substrate. If the coating is a 100% solid, the process is called “Extrusion” and in this case, the line speed of the material is much faster than the speed of the extrusion. This enables coatings to be considerably thinner than the width of the slot. This method is commonly used in making carboard laminates using “hot melt” adhesives.



IMMERSION COATING: This is a very simple process. The substrate is dipped into a bath of coating, which is normally of a low viscosity to enable the coating to run back into the bath as the substrate emerges. It is sometimes aided using rollers on exiting the bath to smooth the coating. This process is frequently used on porous substrates with the intent of saturating and filling up the pores of the material.



METERING ROD COATING: This process is sometimes called “Meyer Rod” coating. In this process, an excess of the coating is deposited onto the substrate as it passes over a bath roller. The wire-wound metering rod, sometimes known as a Meyer Rod, allows the desired quantity of the coating to remain on the substrate. The quantity remaining is determined by the diameter of the wire used on the rod. The viscosity of the coating and its ability to self-level will determine the uniformity of the finished coating.